

Self-healing Nanocomposites for Reusable Composite Cryotanks, Phase I

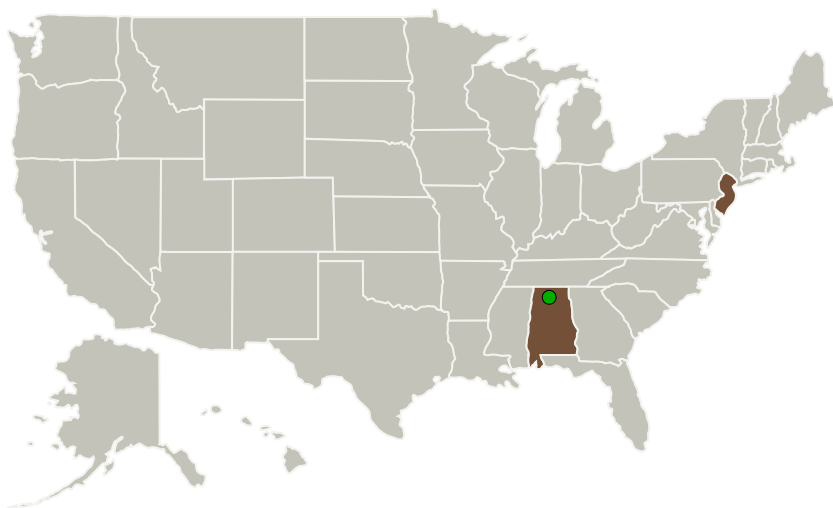
Completed Technology Project (2012 - 2012)



Project Introduction

Composite cryotanks, or Composite Overwrapped Pressure Vessels (COPVs), offer advantages over currently used aluminum-lithium cryotanks, particularly with respect to weight savings. Future NASA missions are expected to use COPVs in spaceflight propellant tanks to store fuels, oxidizers, and other liquids for launch and space exploration vehicles. However, reliability and reusability of the COPVs are of concern, especially in cryogenic temperature applications; this limits adoption of COPVs in future reusable vehicle designs. The major problem with composites is the inherent brittleness of the epoxy matrix, which is prone to microcrack formation, either from exposure to cryogenic conditions or from impact from different sources. If not prevented, the microcracks can grow into larger cracks, leading to catastrophic failure and loss of function of the composite. In addition, the presence of microcracks increases gas permeation and leakage, which is undesirable in a COPV. Accordingly, materials innovations are needed to mitigate microcrack formation in composite cryotanks. In Phase I we propose to demonstrate microcrack prevention and mitigation in COPVs through the use of a novel nanocomposite matrix containing engineered nanoscale materials which will also enable self-healing of microcracks. Phase II will build upon the Phase I program to enable a TRL 5-6 working proof of concept and prototype for NASA testing, capable of long term use with high cycle performance at cryogenic temperatures.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
NEI Corporation	Lead Organization	Industry Small Disadvantaged Business (SDB)	Piscataway, New Jersey
● Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

Primary U.S. Work Locations

Alabama	New Jersey
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Project Transitions

**February 2012:** Project Start**August 2012:** Closed out**Closeout Documentation:**

- Final Summary Chart(<https://techport.nasa.gov/file/138492>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

NEI Corporation

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Daniel E Eberly

Co-Investigator:

Daniel Eberly

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Technology Maturity (TRL)

Start: **2**
Current: **4**
Estimated End: **4**



Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
 - └ TX12.4 Manufacturing
 - └ TX12.4.5 Nondestructive Evaluation and Sensors

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System